

# Contributions of Paul B. Sears to Natural Vegetation Mapping in Ohio

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**ABSTRACT.** Paul B. Sears (1891-1990), using data from original land surveys and both published and unpublished accounts, was the first individual to prepare natural vegetation maps of Ohio. As a youth with a strong curiosity about plants, Sears became especially interested in the native prairie flora south of his home in Bucyrus, Ohio. While Sears was an instructor at The Ohio State University, his desire to study the state's natural vegetation was expanded by Edgar N. Transeau. By 1919, Sears had constructed a map showing the original prairies in relation to the system of moraines in Ohio. In that same year, he began obtaining records of "witness trees" left by land surveyors in the Old Northwest Territory and devised symbols to plot those records on an Ohio map. In 1923, Sears drew a map of virgin forests in Ohio using patterns of lines to show the extent of the different forest types, but it was not published until 1941. His second virgin forest map, published in 1925, used various symbols to indicate oak, beech and ash forests. The same publication included his maps depicting the relationships of oak and beech forests to the moraines and physiographic regions of the state. In 1926, Sears published a map of the natural treeless areas of Ohio showing their correlations with physiography, moraines, preglacial drainage routes and postglacial lakes. Sears prepared 11 natural vegetation maps; two for northwestern Ohio were not published. He published 9 covering the entire state in *The Ohio Journal of Science*. An unpublished 1919 map of Ohio prairies first appears here.

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## INTRODUCTION

Paul B. Sears (1891-1990) was the first individual to prepare a map of the natural forest vegetation of Ohio based on a systematic analysis of field survey records. He also mapped locations of the original prairies in the state using the same methods. Sears' interest in plants began when he was a boy living in northern Ohio, where the woodlots, rail fences and plenty of white pine shipping boxes attracted his attention (Sears 1981). Based on his reading about natural history, three regions appealed to him: oceans, mountains and treeless prairies. Curiosity about prairies also was piqued by stories that his father, Rufus Sears, born in 1860, told of a family trip westward in a covered wagon that crossed the unfenced tall grass country to visit cousins in Nebraska. As the younger Sears' interest in plant life increased, he noticed that the roadside plants south of Bucyrus, many of which belonged to the prairie flora, were quite different from those north of town. These prairie plants grew on farms of the Killdeer Plains between Bucyrus, Marion and Upper Sandusky. In the history books of this area, Sears read about Colonel William Crawford being ambushed by Indians hiding in the tall grass on the lower terrain and oak and hickory trees occupying the drier knolls (Sears, 1981).

## EARLY MAPPING EFFORTS AND METHODS (1915-1922)

The Ohio State University employed Sears as a botany instructor from September 1915 until September 1917, when he entered military service in World War I. After his military service, he returned to Columbus and continued his instructorship from January to June 1919. Edgar N. Transeau joined the faculty of the Department of Botany at the same time as Sears. Transeau's research focused on the distribution of vegetation in relation to climatic factors and mapping natural vegetation. Transeau urged Sears to generalize his interest in the distribution of prairie plants in the Killdeer Plains to include prairie vegetation throughout Ohio. To accomplish this task, Sears initially searched county histories, wrote

to county surveyors and otherwise tried to ascertain the location of prairies in pre-settlement Ohio. In 1919, he began to study the records of the General Land Office for listings of individual trees. Sears studied botanical information in the records made by the federal land surveyors after the Northwest Territory was opened to European settlement in 1786. Those surveyors divided the land into mile-square sections and at or near each corner or "mile post" they noted the location of the most prominent or "witness" trees. Sears realized that the natural forest vegetation of the region before their destruction by European settlers could be inferred by plotting the distribution of various species of witness trees on a map. These techniques for mapping natural vegetation are still used today (Stuckey 1990).

"A Map of Ohio Prairies," the first map that Sears prepared, was the title of a 10-minute presentation delivered on 30 May 1919 at the annual meeting of the Ohio Academy of Science (Sears 1919, Anonymous 1920). Later that year, Sears left The Ohio State University to become an assistant professor of botany at the University of Nebraska. The map for that presentation showing the original prairie areas of Ohio is first published here (Fig. 1).

Sears stated that his investigation was the first attempt "to accurately map the native prairies of Ohio existing at the time of European settlement." In addition to his map (Fig. 1), the investigation "... offered a very concise summary of important evidence bearing on the origin of these prairies," based on published historical accounts, early land survey records, publications on geology and roadside-fencerow remnants of native vegetation. From these sources, Sears concluded that Ohio prairies resulted from successional changes where aquatic habitats decreased as the substrate became drier and plants of prairie communities became established on thick, boulder-free, fine silt soil underlain by a hardpan, with a depth of 100 feet or more to bedrock. These wet, lacustrine prairies occurred within the two great basins of Ohio, the Erie to the north and the Scioto to the south. Sears noted that the distribution of wet prairies in the state correlated with preglacial drainage topography.

How Sears devised the method of using "witness" trees, as a data source for mapping natural forest vegetation, is not completely known. Juliana Mulroy of Denison University, who studied the

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FIGURE 1. Sears' map of the original prairies in Ohio (shaded [original in red ink]) plotted on a map of moraines (stippling). Prepared 1919, but not published. (Paul Bigelow Sears Papers, Manuscripts and Archives, Yale University Library.) Note: Blocky black areas in Lucas, Cuyahoga, Stark, Montgomery and Hamilton counties are cities as are concentric circles in Summit and Stark counties.



Sears' archives at Yale University, believes that some insight can be gleaned from a letter of 19 May 1919, sent by William F. Schepplin, surveyor of Sandusky County, in response to the Sears letter of 16 May 1919 asking Schepplin for information about the locations of original prairies in the county. The surveyor replied with a letter and map providing general locations for three prairies. Schepplin stated:

I have noticed in the old Government surveys mention of prairie and open land in different parts of the county. They, however, were small, and if you desire to go into the matter any further, our records and the original Government surveys made about 1820, are open for your inspection, together with the field notes on same, and if time were taken one could prepare a very complete map of the entire county from these notes.

Sears followed this lead. Nearly a year later, while at the University of Nebraska, he inquired about these government survey records by writing to Warren G. Harding, then Senator from Ohio and later President of the United States. Harding sent a letter to the General Land Office in the Department of the Interior, Washington, DC. Acting Assistant Commissioner, D.K. Parrott answered it on 4 May 1920. Sears' request was to obtain "the description of the bearing trees to the corners set by the United States at the time of the original survey." The Commissioner provided the location of the records and stated that as surveyed in Ohio under the rectangular system, there would be "27,520 corners, the description of which in the field notes would have to be searched for and the bearing trees, if any, noted. The records...are at all times open to the public." Sears pursued this line of investigation and, in April 1921, his first paper on the subject, "Vegetation Mapping," was published (Sears 1921). There he stated that accurate maps of native vegetation are extremely valuable but maps of large areas are usually impressionistic and perhaps only partially accurate. An essential condition for creating accurate maps of large areas is to acquire already extant, precise, local maps or make new local maps as accurately as possible and combine them into a larger map.

Sears (1921, 1926b) devised a set of arbitrary symbols that could be transcribed readily and easily onto any appropriate base map (Fig. 2). Three major categories of symbols represented three natural vegetation types: oak-hickory forests, floodplain and beech-maple forests. Sears (1921) described the procedure for using these symbols. The species of bearing trees at each section corner were transcribed onto a grid sheet with one centimeter or one-quarter

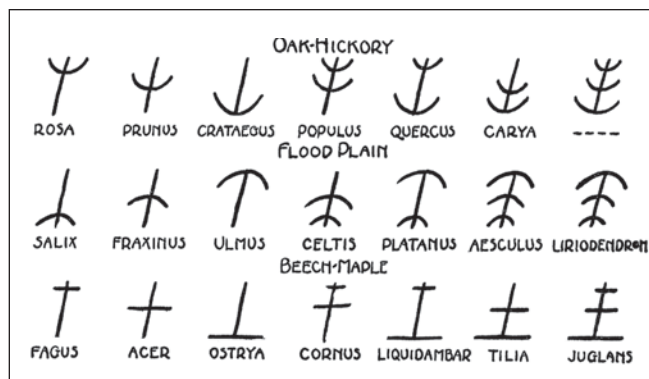


FIGURE 2. A sample of Sears' penmanship symbols used in natural vegetation mapping when transcribing witness tree data from maps and records of the original land surveys made by the federal government from the late 1700s until about 1820 in northern Ohio (Sears 1921, p 325). Reprinted with permission of *Science*.

inch squares. If a color-coded map is desired, colors are assigned to each species and then transcribed by means of properly colored dots to grid paper. This method demonstrated a map prepared from the records of specimen trees at one-mile intervals affords a map of native vegetation, within an area as small as twenty miles square.

Sears' second map showing the natural vegetation of the Lake Erie Basin in northwestern Ohio is apparently the one presented at the annual meeting of the Ohio Academy of Science in 1922 (Anonymous 1923). During the 1970s, a glass lantern slide of this map (Fig. 3) was located among Transeau's slides of maps in the Department of Botany, The Ohio State University and published by Stuckey and Reese (1981).

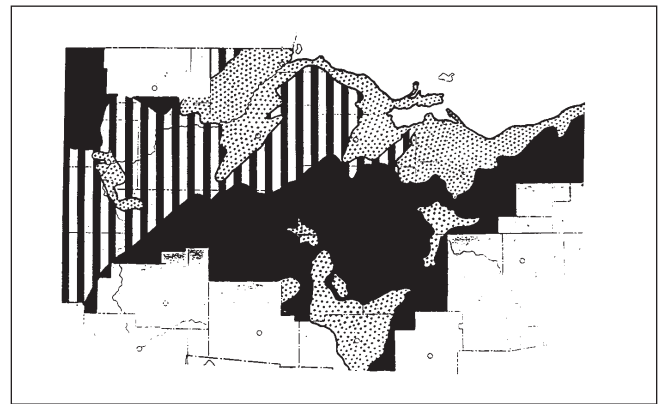


FIGURE 3. Sears' map of natural vegetation zones of the western Lake Erie Basin in northwestern Ohio: black = beech forests, striped = swamp forests, stippled = prairies and marshlands. Prepared 1922 and apparently presented at annual meeting of the Ohio Academy of Science that year (Anonymous, 1923; map published in Stuckey and Reese, 1981, p 3).

## THE FIRST VIRGIN FOREST MAP OF OHIO (1923-1924, 1940-1941)

Sears presented his first map of the virgin forest of Ohio in December 1923 during a symposium on "Ohio Ecology" held under the auspices of the Ecological Society of America at the Cincinnati meeting of the Association for the Advancement of Science (Anonymous 1925b). The suggestion for this symposium originated with Sears in a letter of 28 August 1923 to Henry C. Cowles, his graduate mentor at the University of Chicago. Cowles (1923) replied to Sears on 16 September 1923, stating his approval of the idea and agreeing to consult Charles C. Adams and Asa Weese, members of the organizing team. In a letter of 20 October 1923 to Transeau (Transeau 1924), Sears outlined a proposed series of short papers for the program to be presented by Transeau, Homer C. Sampson, John H. Schaffner, E. Lucy Braun and Adolph E. Waller. All of the proposed speakers participated except Schaffner who was replaced by Paul D. Strausbaugh of West Virginia University. The program listing the names of the speakers and titles of their papers appears in the "Summary Report of the Third Cincinnati Meeting" (Anonymous 1925a). Abstracts of papers by the above-named speakers were published in the *Bulletin of the Ecological Society of America* (Anonymous 1924). Transeau intended to have the full papers published together in *The Ohio Journal of Science*, but that publication never appeared. In his published abstract, Sears (1924a) noted that his map was based on records left by surveyors between 1798 to about 1820. He described the map as follows: "The following major associations are to be recognized: Beech-Maple, Red-Oak-Linden, White Oak (including Oak Hickory,

etc.), Southeastern Complex. The three first named are limited to the glaciated region of the state, while the fourth occupies the unglaciated region plus the lower Miami valley."

Broadly speaking, unglaciated areas are largely xerarch with a floristic composition of species with a southern or eastern distribution. Glaciated areas, mainly hydrarch, were inhabited initially by species with a northeastern distribution followed by a floristic composition with preponderance of species with a Mississippi River valley distribution. In the Erie Basin, a sequence of vegetation change is distinct with this sequence: Lake, White Oak-Hickory (including prairie), Red Oak-Linden, Beech-Maple (including bogs). Beech-Maple is limited roughly to the morainic system while White Oak-Hickory indicates the position of the more recent shallow post-glacial lakes.

The map Sears prepared for the symposium had the title, "Ohio Virgin Forest 1798-1820" with the printed notation "P.B. Sears-23" (Fig. 4). Sears showed the extent of the original forest types as follows: horizontal and vertical lines together for beech and sugar maple; horizontal lines close together for ash, elm, silver maple; no lines for oak and hickory; horizontal lines wide apart for mixed forest; and slanting lines for chestnut.

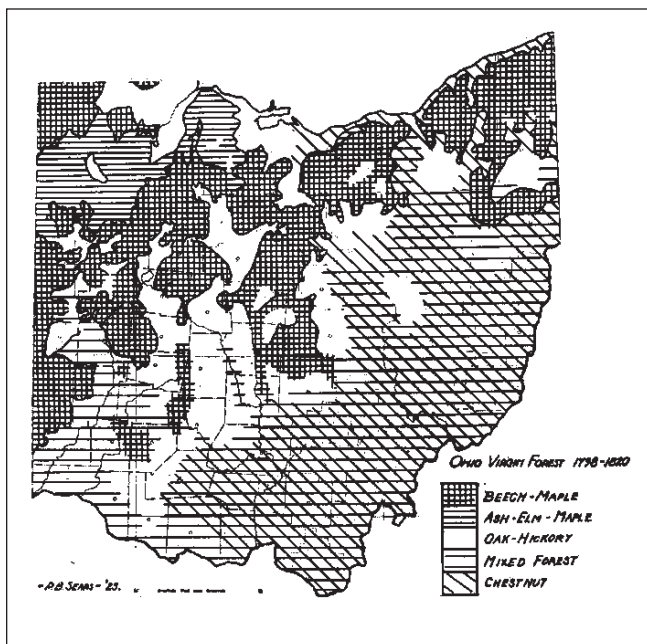


FIGURE 4. Sears' "Map of the Virgin Forest of Ohio" based on the original land survey records made by the federal government from 1798 to 1820, showing five forest types; see key at lower right. Prepared in 1923, published by Sears (1941, p 226).

In two 1924 letters to Sears, Braun (1924) showed considerable interest in his map. She was one of the associate editors of a forthcoming book on the preservation of natural habitats by a committee of the Ecological Society of America. Braun produced a map outlining the physiographic regions of the state and wanted to include on it the features of Sears' map. Sears (1924b) granted permission and sent her a copy of his map to Braun. The published map (Braun 1926) showed the correlation of virgin forests and physiography (Fig. 5).

Sears resurrected his 1923 map of the "Ohio Virgin Forest" when he delivered an invitational address on postglacial vegetation

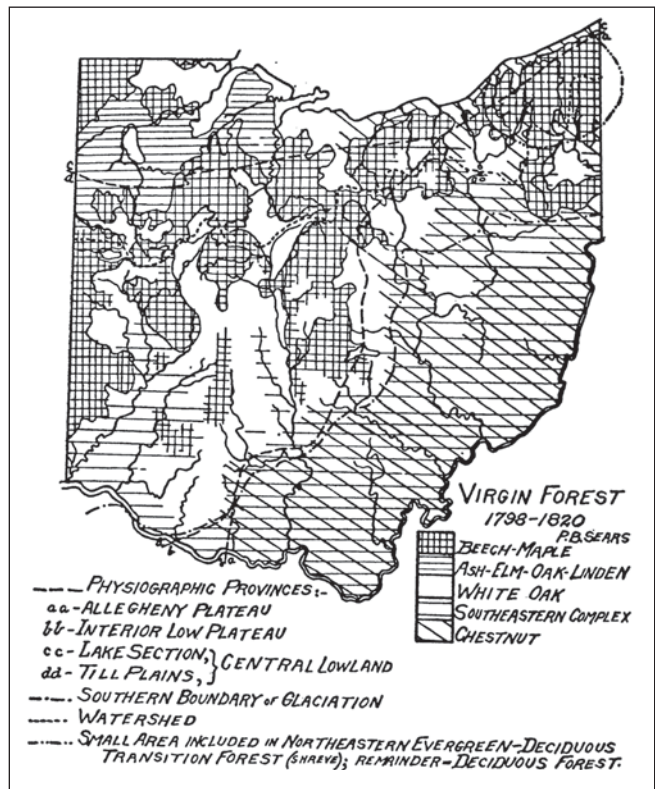


FIGURE 5. Sears' "Map of the Virgin Forest of Ohio" (Fig. 5) with lines added by E. Lucy Braun showing boundaries of the physiographic provinces of the state; see key at lower left. Published by Braun (1926, Fig. 12, opp. p 354).

at the Fiftieth Anniversary Celebration of the Ohio Academy of Science in May 1940. With reference to the map, he made the following observations. First, factors controlling the diversity of Ohio's natural vegetation are complex and no single factor can be given as an explanation for the resulting pattern. For example, no map of climatic configuration can be superposed over the original vegetation map to produce any reasonable correlation. Second, some evidence can be noted for large physiographic influences such as glacial features and lake retreat. Third, the natural vegetation pattern has had a profound influence on agricultural and industrial life in the state. By applying the results of these vegetation studies, scientifically-based solutions can be applied to problems of pest control, land use and management of natural resources. In the publication of Sears' address, his 1923 map of the "Ohio Virgin Forest" appeared unmodified 18 years after it was first drawn (Sears, 1941).

## A SECOND OHIO VIRGIN FOREST MAP (1925)

A second "Map of the Virgin Forest of Ohio" prepared and published by Sears (1925) used symbols to indicate the original, dominant, forest communities: circles for oak and hickory; plus signs for beech and sugar maple; and times signs for ash, elm and silver maple (Fig. 6). The unit mapped within each county was the township, five or six miles square. The symbol selected for each township represented the witness tree having the most recorded occurrences. Arrows placed at the lower half of the above three symbols point toward the approximate present-day centers of the distribution of additional species. Arrows pointing northeast indicated the presence of hemlock; arrows to the southeast indicated



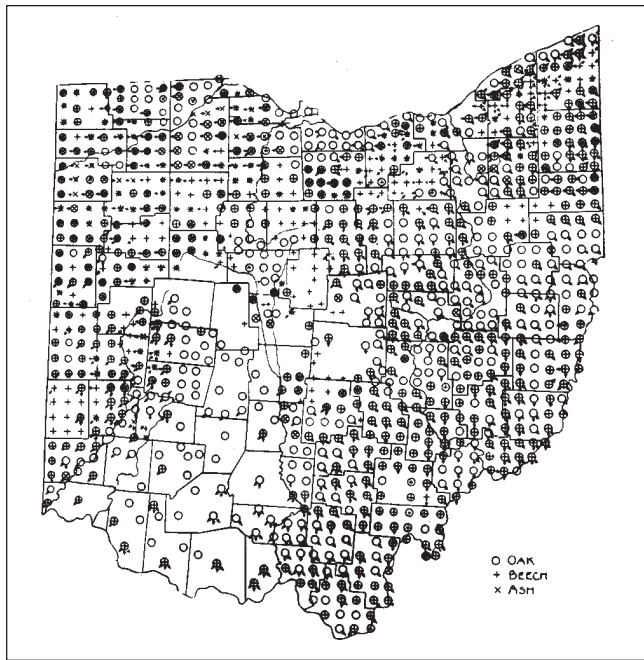


FIGURE 6. Sears' second "Map of the Virgin Forest of Ohio" based on the original land survey records made by the federal government from 1798 to 1820; see key at lower right; Sears provided these notes with the map: " 'Beech' designates pure stands of beech, also beech-maple with (often) more or less red oak and white ash. 'Oak' includes white oak, hickory, bur oak, black oak; also chestnut-chestnut oak. 'Ash' designates black ash-white ash, usually with elm, and often with red maple." Published by Sears (1925, p 142).

chestnut, chestnut oak, scrub and pitch pines; arrows to the south indicated black cherry, cucumber magnolia, sweet and black gums and tulip poplar; arrows to the southwest indicated sweet and Ohio buckeyes, dogwood, hackberry, sycamore and black walnut; arrows to the west indicated linden, ironwood and cottonwood.

In counties where information on the distribution of witness trees was incomplete or lacking, additional data were obtained from county histories, the early volumes of the Ohio Geological Survey, journals of travelers, verbal descriptions and other historical sources. With the exception of the southern and eastern positions of Ohio, Sears had frequent opportunities to check historical records against the present-day field conditions. White space on this map indicates that data were still needed for three regions of the state: the Symmes Purchase east of the Miami River in extreme southwestern Ohio, the Virginia Military District, an extensive area of 16 or more counties of central and southwestern Ohio and the western half of the United States Military District of Delaware, Franklin and Licking counties in central Ohio. George D. Fuller (1925) called Sears' publication "an interesting investigation of the original vegetation of Ohio."

Sears (1925) pointed out a correlation of the natural tree vegetation with certain physical features such as the distribution of oak and beech in relation to the system of glacial moraines (Fig. 7). The most extensive vegetation type was oak-hickory, most abundant on hilltops in the unglaciated area of southeastern Ohio. Oak was predominant near the apex of glaciated areas where ground and terminal moraines intermingle in the glaciated portion of northern Ohio. Oak mostly grows on elevated terrain or knobs, rather than in depressions that developed into swamps or wet prairies. Oak occurred on other sites in northern Ohio including beach dunes in Fulton and Lucas counties, limestone ridges near Sandusky Bay and high, exposed cliffs along the south shore of Lake Erie. Beech

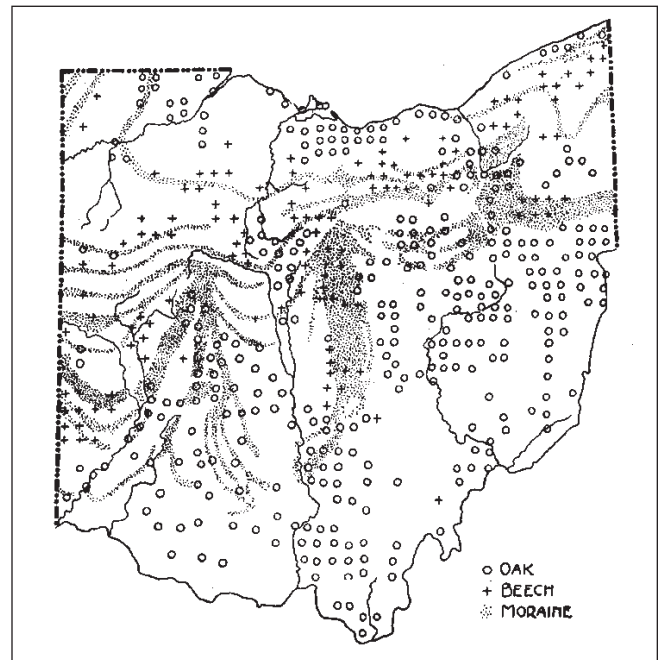


FIGURE 7. Sears' map showing distribution of native oak and beech forests in relation to the system of moraines in Ohio; see key at lower right. Published by Sears (1925, p 148).

and sugar maple constituted the second most extensive vegetation type. It was best represented in glaciated portion of the state and was correlated with the moraine system, being most abundant along the edges of terminal and lateral moraines. In the unglaciated portion of the state, beech was interspersed with southern mesophytes throughout dense upland forests and in ravines. Ash, elm and silver maple were developed best on broad inter-morainal flats or ground moraines within the Lake Erie Plain or Black Swamp and on the Scioto and Grand River Lobes.

Sears (1925) also outlined eight physiographic regions of the state, all of which were drawn on his map of the virgin forest. These regions were represented by lines dividing the Lake Erie Plain from the Allegheny Plateau, the Lake Erie watershed from the Ohio River watershed, glaciated regions from unglaciated regions and Carboniferous bedrock from Devonian bedrock (Fig. 8).

The boundary between Carboniferous and Devonian bedrock vertically bisects the state. To the east of that line are mainly sandstones and shales creating a substrate that tends to be acidic and to the west, bedrock is limestone, dolomite and local pockets of shale near the line, creating a substrate that tends to be alkaline. Southeastern species (for example, chestnut, chestnut oak, pitch pine, scrub pine, cucumber magnolia, tulip poplar, gums and black cherry) occurred principally on Carboniferous substrates east of the Devonian boundary. Southwestern species (for example, buckeye, black walnut, hackberry and sycamore) were most numerous in the glaciated Ohio Basin-Allegheny Plateau in the southwestern part of the state. From there, these species diverged eastward and northward along the Upper Ohio River and its tributaries, the Scioto and the two Miami Rivers. Western species, such as ironwood, linden and cottonwood, were most common in the Lake Erie Plain of northwestern Ohio. Northern species, such as hemlock and white pine, were most abundant on the glaciated Devonian substrate in

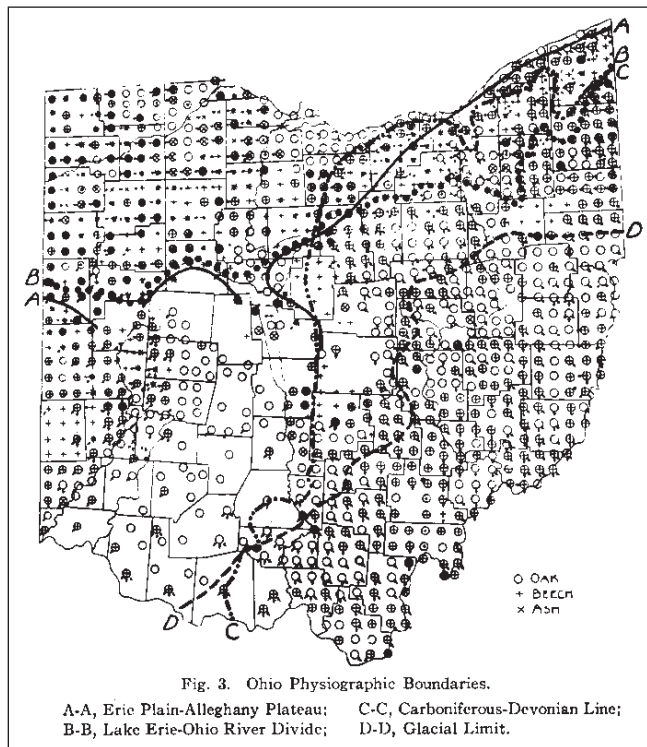


FIGURE 8. Sears' "Map of the Virgin Forest of Ohio" with additions of four physiographic boundaries, listed beneath the map. Published by Sears (1925, p 145).

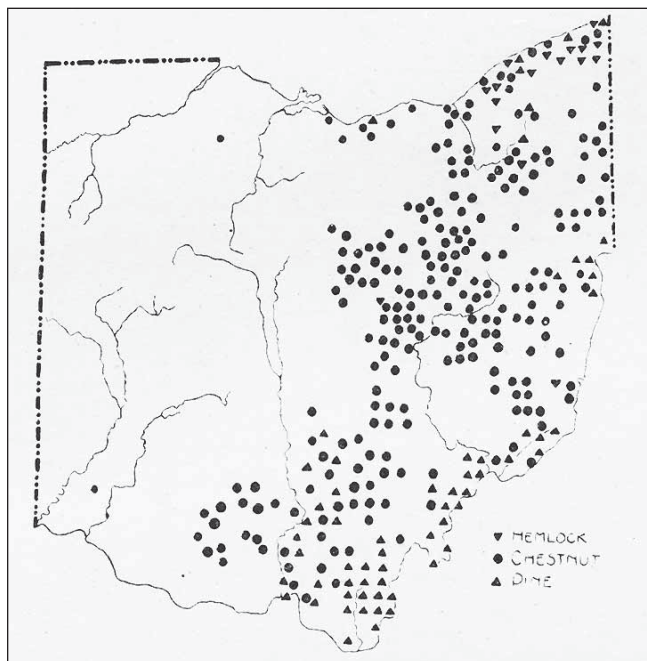


FIGURE 9. Sears' map based on records of hemlock, chestnut and pine in the virgin forest of Ohio; see key at lower right. Published by Sears (1925, p 146).

the northeastern corner of the state. Hemlock also occurred farther south in deep, damp and sheltered north-facing ravines.

On a separate Ohio map, Sears (1925) used three symbols to depict the distributions of hemlock, chestnut and pine as indicated in the records of the early surveyors. This map showed the three genera confined mostly to the Carboniferous sandstone region of eastern Ohio (Fig. 9). The highest number of woody species occurred in northeastern Ohio, where several of the physiographic regions are narrow and most closely approach each other.



FIGURE 10. Sears' map of treeless areas in the natural vegetation of Ohio based on records from 1750-1850 and checked by him through field observations. Symbols (see key at lower right) are plotted on a base physiographic land-relief map (Sherman 1922). Published by Sears (1926a, p 129).

### MAPS OF TREELESS AREAS OR PRAIRIES (1926)

Sears' second paper on the Natural Vegetation of Ohio concerned treeless areas or prairies (1926a). In addition to prairies, eight terms with narrower meanings also referring to these open areas were defined: wet prairie, dry prairie, bog, swamp, swale, marsh, barren and oak opening. For mapping purposes, he combined swamp, swale and marsh into one category, labeled "swamp," and assigned one symbol. Thus, Sears used one symbol for prairies in general plus six other symbols to plot these natural treeless areas on the Ohio physiographic land relief map drawn by Christopher E. Sherman (1922). By comparing the positions of these treeless areas with the physiographic regions, Sears' map (Fig. 10) showed that treeless areas were practically absent from the unglaciated portion of the state but occurred in groups throughout the length of the Ohio-Erie Divide. These groups also extended to the southeast of the Divide in a series of crescent-like formations. Another series occurred to the north of the Divide in the Erie Plain, mostly coinciding with the ancient beach ridges of former stages of Lake Erie. The innermost of those ridges delimited the present-day marshes and wetlands along the shoreline of Lake Erie. Sears (1926a) noted that the original prairies coincided with areas of oak on the virgin forest map as shown by combining these two parameters on a new map prepared by this author (Fig. 11). These original prairies were prominent in five regions of the state: (1) sand dunes of Fulton, Lucas and Wood counties; (2) thin soil over limestone in Sandusky, Erie, Seneca and Huron counties; (3) sandy areas of Wayne and Stark counties; (4) the Sandusky Plains of Wyandot, Marion and Crawford counties; and (5) the Darby Plains of Union, Madison and adjacent counties.

The presence of prairies only in the glaciated region of the state, along with their parallel crescent-shaped arrangement, suggested to Sears (1926a) a correlation with the system of glacial moraines.



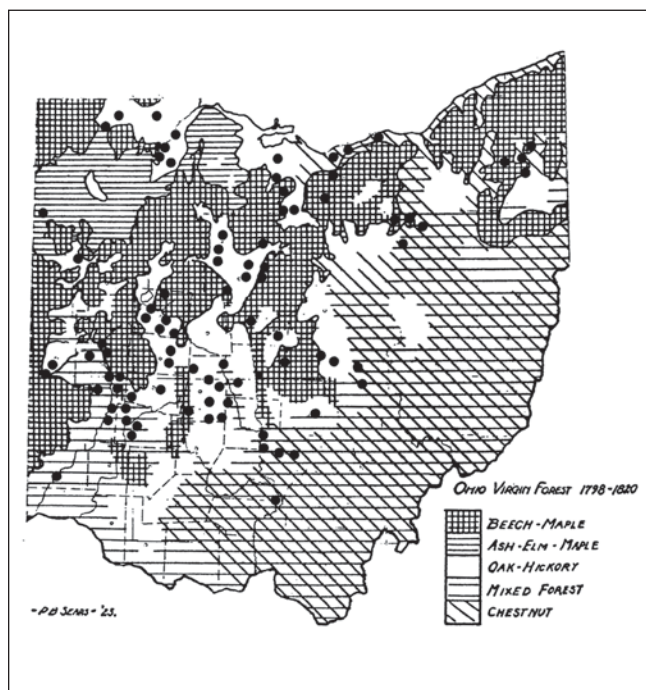


FIGURE 11. Sears' first "Map of the Virgin Forest of Ohio" (1923) plus locations of original prairies taken from Sears' map of treeless areas (1926a, p 129). Note that most original prairies coincide with areas of "oak-hickory". New map prepared by the author, 1991.

In most cases, the radii of these small prairie sites approximated the direction glacial ice moved as verified by the striae left on the bedrock. Like the distribution of oak in the virgin forest, prairies generally occupied areas near the apices of various glacial advances (or retreats), where outwash valleys and ponds occurred. Among these localities were ponds in Mercer and other counties, flats in Marion County and filled preglacial valleys along the Miami River and in Pickaway County. Unlike oak, which was on the higher ground, the prairies occupied mostly depressions, which were shallow lakes or seasonal ponds in earlier times.

Four distinct zones or belts of treeless areas, corresponding to the former beach ridges of ancient Lake Erie, are identifiable within the Lake Erie Plain, in what was the Maumee River Valley of northwestern Ohio (Sears 1926a). Bogs were associated with the two outer (or oldest) beach ridges, but not with the two inner (or youngest) beach ridges. Two of the beach ridges culminated in sand dunes at their northern extensions, resulting in oak openings on the high portions and wet meadows in depressions. Between the ancient beach ridges, wet prairies also occupied former embayments in Wood, Sandusky, Van Wert and Huron counties. Prairies were lacking upon the glaciated Allegheny Plateau north of the Ohio-Erie Divide, but along the Divide, prairies abounded mostly in postglacial lakes or inadequately drained depressions. Distinct groups of these wet prairies occurred in Mercer, Hardin, Wyandot-Marion-Crawford, Ashland-Wayne, Wayne-Stark-Summit, Portage-Mahoning and Trumbull Counties. In Mercer, Ashland, Stark and Wayne counties, these wet prairies marked the course of deep, buried and silted preglacial drainage valleys. Southward from the Ohio-Erie Divide, prairies occurred in the Miami Valley, Darby Plains, Scioto Valley and Licking Valley, all of which coincided, at least in part, with great preglacial valleys, now silted or gravel-filled. From these correlations, Sears (1926a) predicted, "so striking is the relation between preglacial topography and natural vegetation that .... a

great preglacial valley will probably be found running northward through Champaign, Logan, Hardin and Hancock Counties and another north westward through Marion and Wyandot Counties."

Later Ver Steeg (1946) confirmed Sears' prediction of the stream courses of the preglacial valleys in western Ohio. Andreas (1985) demonstrated further the correlation between preglacial stream channels and the distribution of treeless areas, represented by bogs and fens in Ohio. She plotted 114 peatland locations on maps of buried river valleys published by Stout et al. (1943) and Cummins (1959). Her maps showed that 68 were underlain by the Teays River and its tributaries and 25 others were associated with pre-Wisconsinan buried valleys of Ohio. Thus, 93 of the 114 bog and fen localities in Ohio occurred over buried river valleys, which demonstrated a remarkable correlation first predicted and mapped by Sears in his initial studies of the natural vegetation.

Of the 11 natural vegetation maps that Sears prepared, his 1923 "Ohio Virgin Forest Map" has been the most popular and was reproduced in later publications (Sears 1961) and Stuckey (1990, 1991). With the availability of his known natural vegetation maps, it is possible to construct new maps showing correlations of these original vegetation types with other data sources (Stuckey 1991, p 26-33). New maps also can correlate vegetation with either natural features (for example, bedrock, glaciation, or soils) or artificial parameters (those derived from the activities of humans).

Sears' methods for mapping natural vegetation have been adopted in other areas of the United States where similar kinds of land surveys were conducted; for example, Lutz (1930) in northwestern Pennsylvania; Kenoyer (1930, 1934, 1940) in southern Michigan; and Gordon (1940) in southwestern New York. Sears' methodology and philosophical understanding have influenced numerous studies of natural vegetation mapping throughout the past 85 years.

## SUBSEQUENT STUDIES ON VEGETATION MAPPING IN OHIO

Sears' contributions toward mapping the natural vegetation of Ohio were used in the project that continued at The Ohio State University under the leadership of Transeau and his associate, Homer C. Sampson. Numerous students of Transeau studied and mapped the natural vegetation of various counties and regions of Ohio as part of their master's theses and doctoral dissertations. At the time of their deaths in 1960 and 1963, respectively, Transeau and Sampson had not completed their study of the original vegetation (Gordon 1981, Stuckey 1981).

In 1964, John N. Wolfe, Gareth E. Gilbert and Charles A. Dambach, all at The Ohio State University, revived the project and invited Transeau's former student, Robert B. Gordon, retired from teaching at West Chester State College, Pennsylvania, to complete the natural vegetation map of Ohio. The studies completed by Transeau's students, mostly done on a county-by-county basis, were reevaluated by Gordon and the original land survey records extant for many counties not studied by Sears or by Transeau and his students were located and synthesized into a new 35-inch x 38-inch, eight-colored, comprehensive map (Gordon 1966). This widely acclaimed map was the first of its kind in scope and methodology prepared for any state in the United States. Smaller, less detailed versions of the map have been reproduced in books, journals, magazines and on postcards.

To provide an informative, descriptive summary of Ohio's original vegetation, Gordon (1969) prepared a 113-page bulletin. Jane L. Forsyth (1970) reviewed Gordon's map, noting many close correlations of the vegetation types with geological substrates. Sears

(1970) acknowledged Gordon's intimate field knowledge of Ohio's vegetation, his thorough and critical review of the available data and his "excellent map", all representing a "demonstration of the broad approach which is the essence of ecology." Gordon (1969) summarized the usefulness of the natural vegetation survey:

During the past fifty years, there has been a growing body of evidence that natural vegetation, if it can be correctly ascertained, provides the best possible means of judging the potentiality of the environment which has existed locally for the past thousand years. It appears basic to the environmental sciences, which loom large in importance to the requirements of modern civilization and in planning for future land use. Techniques are yet to be developed in making adequate use of such data that already have accumulated.

**ACKNOWLEDGMENTS.** My thanks are extended to many individuals who have inspired or assisted me in various phases of research on the life and work of Paul B. Sears. To the late William S. Benninghoff, I owe a deep gratitude for bringing to my attention Sears' studies on natural vegetation mapping and the use of fossil pollen analysis to interpret vegetational history, while I was a graduate student in his classes at the University of Michigan. I also thank William R. Burk, Lynn E. Elfner, Charles C. King, Edward G. Voss and Mohan Wali, who have provided help and inspiration in my work on the natural vegetation of Ohio. Juliana C. Mulroy of Denison University provided the information used and cited from Sears' papers in the Archives of Yale University. She and her student, Amanda R. Newman, offered valuable editorial comments. My former students, J. Perry Edwards, Tracy Engle and Richard Greter, assisted with library work, map production and word processing. Kathy Royer completed word processing for the first revised manuscript copy. Citations mentioning Yale University are from information provided by Juliana C. Mulroy. Originals are in The Paul Bigelow Sears Papers, Manuscripts and Archives, Yale University Library.

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